CLAIMS

WHAT IS CLAIMED IS:

1. A method for directly delivering a substance into an intradermal space within a mammal, the method comprising administering said substance into the intradermal space, whereby the administered substance has improved pharmacokinetics relative to the same substance when administered subcutaneously to the same mammal.

2. The method of claim 1 wherein the administering is through at least one small gauge hollow needle.

3. The method of claim 2 wherein the needle has an outlet with an exposed height between 0 and 1 mm.

4. The method of Claim 3 wherein administering comprises inserting the needle to a depth which delivers the substance at least about 0.3 mm below the surface to no more than about 2 mm below the surface.

5. The method of Claim 4 wherein administering comprises inserting the needle into the skin to a depth of at least about 0.3 mm and no more than about 2 mm.

6. The method of claim 1, wherein the improved pharmacokinetics comprises increased bioavailability of the substance.

7. The method of claim 1 wherein the improved pharmacokinetics comprises a decrease in T_{max}.

8. The method of claim 1 wherein the improved pharmacokinetics comprises an increase in C_{max}.

9. The method of claim 1, wherein the improved pharmacokinetics comprises a decrease in T_{lag}. Also claim increase in k_a

10. The method of claim 1, wherein the improved pharmacokinetics comprises an increase in k_a

11. The method of claim 1 wherein the substance is administered over a time period of not more than ten minutes.

12. The method of claim 1 wherein the substance is administered over a time period of greater than than ten minutes.

13. The method of claim 1 wherein the substance is administered as a solution in an amount between 1 nL and 2000 nL.

14. The method of claim 1 wherein the substance is administered at a rate between 1nL/min and 300 mL/min.

15. The method of claim 1 wherein said substance is a hormone.

16. The method of claim 10 wherein said hormone is selected from the group consisting of insulin and PTH.

17. The method of claim 1 wherein said substance is a nucleic acid.

18. The method of claim 1 wherein the substance has a molecular weight of less than 1000 daltons.

19. The method of claim 1 wherein the substance has a molecular weight greater than 1000 daltons.

20. The method of claim 1 wherein said substance is hydrophobic.

21. The method of claim 1 wherein said substance is hydrophilic.

22. The method of claim 1 wherein the needle(s) are inserted perpendicularly to the skin.

23. A method of administering a pharmaceutical substance comprising injecting the substance intradermally through one or more microneedles having a length and outlet suitable for selectively delivering the substance into the dermis to obtain absorption of the substance in the dermis.

24. The method of Claim 23 wherein absorption of the substance in the dermis produces improved systemic pharmacokinetics compared to subcutaneous administration.

25. The method of Claim 24 wherein the improved pharmacokinetics is increased bioavailability.

26. The method of Claim 24 wherein the imporved pharmacokinetics is decreased T_{max}.

27. The method of claim 24 wherein the improved pharmacokinetics is an increase in C_{max}.

28. The method of claim 27 wherein the improved pharmacokinetics is a decrease in T_{lag}.

29. The method of claim 23 wherein the length of the microneedle is from about 0.5 mm to about 1.7 mm.

30. The method of Claim 23 wherein the microneedle is a 30 to 34 gauge needle

31. The method of Claim 23 wherein the microneedle has an outlet of from 0 to 1 mm

32. The method of Claim 23 wherein the microneedle is configured in a delivery device which positions the microneedle perpendicular to skin surface.

33. The method of Claim 23 wherein the microneedle needle is contained in an array of microneedles needles.

34. The method of Claim 33 wherein the array comprises 3 microneedles.

35. The method of Claim 33 wherein the array comprises 6 microneedles.

36. A microneedle for intradermal injection of a pharmaceutical substance, wherein the microneedle has a length and outlet selected for its suitability for specifically delivering the substance into the dermis.

37. The microneedle according to claim 36 wherein the length of the microneedle is from about 0.5 mm to about 1.7 mm.

38. The microneedle of Claim 36 which is a 30 to 34 gauge needle

39. The microneedle of Claim 36 which has an outlet of from 0 to 1 mm

40. The microneedle of Claim 36 which is configured in a delivery device which positions the microneedle perpendicular to skin surface.

41. The microneedle of Claim 36 which is in an array of microneedles needles.

42. The microneedle of Claim 41 wherein the array comprises 3 microneedles.

43. The microneedle of Claim 41 wherein the array comprises 6 microneedles.

44. A method for administering a macromolecular and/or hydrophobic pharmaceutical substance to a patient, the method comprising selectively delivering the substance intradermally to achieve a substantially higher C_{max} and/or a substantially shorter T_{max} and/or a substantially shorter time to reach a threshold blood serum concentration for pharmaceutical effect of the substance, by comparison with subcutaneous administration of the substance at an identical dose and rate of delivery.

45. The method of claim 44 wherein selectively delivering the substance intradermally comprises selectively injecting the substance intradermally.

46. The method of claim 44 wherein administering comprises infusing the substance over a period of from about 2min to about 7 days.

47. The method of claim 46 wherein administering comprises delivering a metered bolus of the substance over a period of from about 2 to about 15minutes.

48. The method of claim 44 wherein administering comprises delivering a bolus of the substance over a period of less than 2 minutes.

49. The method of claim 44 wherein administering the substance intradermally comprises administering the substance through a needle having a length and outlet configuration which allows selective intradermal delivery of the substance.

50. The method of claim 49 wherein the microneedle has a length of from about 0.5 mm to about 1.7 mm.

51. (Prov)The method of claim 44 wherein the microneedle is a 30 to 34 gauge needle

52. The method of Claim 44 wherein the microneedle is configured in a delivery device which positions the microneedle perpendicular to skin surface.

53. The method of Claim 44 wherein the microneedle needle is in an array of microneedles microneedles.

54. The method of Claim 53 wherein the array comprises 3 microneedles.

55. The method of Claim 53 wherein the array comprises 6 microneedles.

56. The method of claim 44 wherein the substance is administered at a volume rate of from about 2 microliters per minute to about 200 microliters per minute.

57. The method of claim 56 wherein the substance is administered at a volume rate of from about 2 microliters per minute to about 10 microliters per minute .

58. The method of claim 54 wherein the substance is administered at a volume rate of from about 10 microliters per minute to about 200 microliters per minute .

59. The method of claim 44 wherein the substance comprises a polysaccharide.

60. The method of claim 59 wherein the substance comprises heparin molecule or a fragment thereof having anticoagulant activity.

61. The method of claim 60 wherein the substance comprises Fragmin®.

62. The method of claim 44 wherein the substance comprises a protein.

63. The method of claim 62 wherein the substances comprises a human growth hormone.

64. The method of claim 63 wherein the substance comprises Genotropin®.

65. The method of claim 62 wherein the substance comprises a human insulin.

66. The method of claim 62 wherein the substance comprises parathyroid hormone.

67. The method of claim 63 wherein the substance comprises a pegylated protein.

68. A method for delivering a bioactive substance to a subject comprising :

contacting the skin of the subject with a device having a dermal-access means for accurately targeting the dermal space of the subject with an efficacious amount of the bioactive substance.

69. The method of claim 68 wherein the pharmacokinetics of the bioactive substance is improved relative to the pharmacokinetics of the substance when administered subcutaneously.

70. The method of claim 69 wherein the improved pharmacokinetics is an increase in bioavailability.

71. The method of claim 69 wherein the improved pharmacokinetics is a decrease in T_{max}.

72. The method of claim 69 wherein the improved pharmacokinetics comprises an increase in C_{max} of the substance compared to subcutaneous injection.

73. The method of claim 69 wherein the improved pharmacokinetics is a decrease in T_{lag}.

74. The method of Claim 68 wherein the device has a fluid driving means including a syringe, infusion pump, piezoelectric pump, electromotive pump, electromagnetic pump, or Belleville spring.

75. The method of Claim 68 wherein the dermal access means comprises one or more hollow microcannula having a length of from about 0.5 to about 1.7 mm- mm.

76. The method of Claim 68 wherein said dermal access means comprises one or more hollow microcannula having an outlet with an exposed height between 0 and 1 mm.

77. A method for delivering a bioactive substance to a subject comprising:

contacting the skin of a subject with a device having a dermal-access means for accurately targeting the dermal space of the subject with an efficacious amount of the bioactive substance at a rate of 1 nL/min to 200 ml/min.

78. The method of claim 77 wherein the rapid onset pharmacokinetics of the bioactive substance is substantially improved relative to subcutaneous injection.

79. The method of claim 78 wherein the bioavailability is increased.

80. The method of claim 78 wherein the pharmokinetics is a decreased T_{max}.

81. The method of claim 78 wherein the pharmokinetics is an increased C_{max}.

82. The method of claim 81 wherein the pharmokinetics is a decreased T_{lag}.

83. The method of Claim 77 wherein the dermal access means has one or more hollow microcannula that inserts into the skin of said subject to a depth of from about 0.5 to about-2.0 mm.

84. The method of Claim 77 wherein the dermal access means has one or more hollow microcannula having an outlet with an exposed height between 0 and 1 mm.